Mecheleciv

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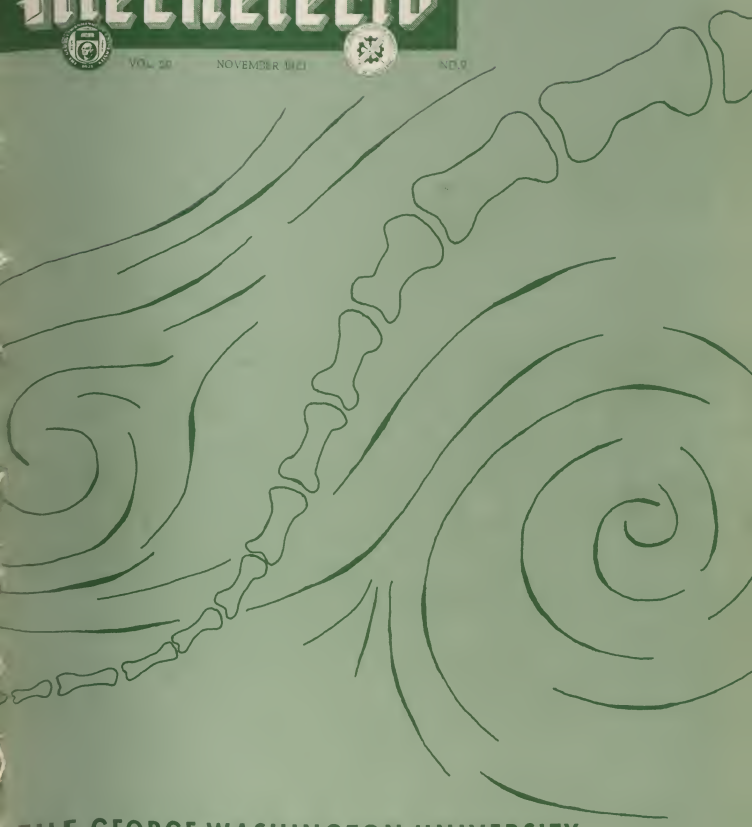

THE GEORGE WASHINGTON UNIVERSITY

NOVEMBER 1961

This mark tells you a product is made of modern, dependable Steel.

How cold is up? We know that outer space can never be colder than minus 459.72° Fahrenheit—that's absolute zero, the point at which all molecular motion ceases. We don't know what coldness like this will do to materials, but we're finding out. Scientists are using a heat exchanger to produce temperatures as low as minus 443° Fahrenheit. They test materials in this extreme cold and see how they perform. Out of such testing have already come special grades of USS steels that retain much of their strength and toughness at −50° or below; steels like USS "T-1" Constructional Alloy Steel, TRI-TEN High Strength Steel, and our new 9% Nickel Steel for Cryogenics applications. And the heat exchanger to produce the −443° Fahrenheit is Stainless Steel! No other material could do the job as well. Look around. You'll see steel in a lot of places—getting ready for the future. ■ For information about the many career opportunities, including financial analysis or sales, write U. S. Steel Personnel Division, Room 6085, 525 William Penn Place, Pittsburgh 30, Pa. U. S. Steel is an Equal Opportunity Employer. USS, "T-1" and TRI-TEN are registered trademarks.

USS United States Steel

I chose a career, not a job!

by Pete Vossos

"I found a satisfying job right from the beginning—and more important, American Oil is diversified enough to offer varied opportunities for the future."

Peter Vossos earned his Master of Science degree at Iowa State, '58. As a physical chemist, Pete's immediate project is studying fundamental properties of asphalts with the objective of improving their performance in roofing and industrial applications. About his 2½ years at American Oil, Pete adds, "This is a company that's big enough and dynamic enough to be doing important work, but not so mammoth that you get lost in the crowd."

Many ambitious and talented young scientists and engineers like Peter Vossos have found challenging careers at American Oil. Their choice could have special meaning to you. American Oil offers a wide range of research opportunities for graduate chemists, chemical engineers, mechanical engineers, physicists, mathematicians and metallurgists.

If you are interested in a career with the Research and Development Department of American Oil Company, write to: D. G. Schroeter, American Oil Company, P. O. Box 431, Whiting, Indiana.

IN ADDITION TO FAR-REACHING PROGRAMS INVOLVING FUELS, LUBRICANTS AND PETROCHEMICALS, AMERICAN OIL AND ITS ASSOCIATE COMPANY, AMOCO CHEMICALS, ARE ENGAGED IN SUCH DIVERSIFIED RESEARCH AND DEVELOPMENT PROJECTS AS:

New and unusual polymers and plastics • Organic ions under electron impact • Radiation-induced reactions • Physiochemical nature of catalysts • Fuel cells • Novel separations by gas chromatography • Application of computers to complex technical problems • Synthesis and potential applications for aromatic acids • Combustion phenomena • Solid propellants for use with missiles • Design and economics: New uses for present products, new products, new processes • Corrosion mechanisms • Development of new types of surface coatings.

AMERICAN OIL COMPANY

Engineers' Creed

As a Professional Engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare.

I pledge–:

To give the utmost of performance;

To participate in none but honest enterprise;

To live and work according to the laws of man and the highest standards of professional conduct;

To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations.

In humility and with need for Divine Guidance, I make this pledge.

The Mechelectiv

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Editorial Page

Personally, and on behalf of the Engineers' Council, I would like to thank the students, the faculty, and the administration of the School of Engineering for the cooperation and support we received during the Homecoming Weekend.

I am sure we are all very proud that our candidate, Rolande Boucher, was elected Homecoming Queen. I would like to share with you the praise I received for our second accomplishment--the Homecoming Float.

The importance of these two achievements by themselves is small, however, compared to what they stand for. They show that the Engineering student body is not the apathetic group that it is made out to be. Furthermore, it proves that when we decide to do a job, we can get it done, and we can do it well.

Another project which deserves the same degree of enthusiasm and support is Engineers' Week, to be held during the week of February nineteenth. In the short time since this project was inaugurated at George Washington, it has grown tremendously. This year our program will be a part of National Engineers' Week, which will be held concurrently. We have invited many business firms to set up displays in Tompkins Hall during this week. However, the high school students, the parents, and the area guests who have been, and will be, invited to this affair are more interested in the efforts of the Engineering student. The public image of The George Washington Engineering School can be greatly affected by the success of this project, and the sole factor in determining this success is the student body.

To find out what you can do to help, contact any member of the Engineers' Council or any of the officers of the professional societies.

Harvey J. Flatt, Secretary
Engineers' Council

COVER STORY

When the final tremors had subsided, when each particle of earth had congealed, life began in forms and kinds long since extinct from the face of the earth. Low lands steamed, waters boiled, and the winds blew with hurricane force. The lands pushed back the sea, the sun baked and hardened, encrusting forever the last remains of this pre-historic age. The winds calmed, the lands stood still, the oceans kissed the shores of this eternal graveyard, and all was quiet for eternity. On this month's cover our artist, Larry Hice, shows an abstract interpretation of the turmoil of wind and sea which through millions of years became symbols preserved in shell and bone of this pre-historic age.

SOIL STABILIZATION through ELECTRO-OSMOSIS

by Herbert S. Wilkinson, E.E.'60

From basic physical chemistry, it is known that when one immerses any metal in an electrolytic solution it exhibits a tendency to give up its surface atoms or molecules as ions. When this occurs the metallic ion (possessing a positive charge such as iron: Fe^{++}) goes into the solution as a free body leaving the surface of the metal body with a negative charge for every free metallic ion. This tendency is termed the electrolytic solution pressure.

In opposition to this effect is the phenomenon called osmotic pressure. This effect is the property of a metallic ion to combine with an oppositely charged particle or body and return to its former atomic or molecular form. In this case, the metallic ion becomes fixed to the surface of the metal body forming a bond with some interior electron of the body giving the body an overall positive charge.

In all metals we have both effects in existence but one usually seems to dominate the other. If, as in the case of noble metals (Cu, Au, Ag, Pt) the osmotic pressure is greater than the solution pressure, the metal gives off negative ions and remains positively charged. If the solution pressure is larger, as occurs for the less noble metals (Zn, Mg, Na, Fe) then the body releases positive metallic ions and remains negatively charged. But in both cases a potential difference appears between the now charged metal body and its electrolytic solution containing the ions. The magnitude of this potential difference will depend upon the type of metal (how noble it is) and the solution that it is immersed in.

The potential difference between the metal and solution brings about what is called the double layer. This double layer for less noble metals consists of the negative ion layer rigidly attached along the immediate surface of the metal body; accompanied by the more freely moving layer of positive metallic ions in the electrolytic solution. The second layer is much wider due to the added freedom of its ionic motion. But the attraction powers of the negative rigid layer keep the second layer close to the metal body. For more noble metals the layers and conditions are the reverse of those described above.

Up to now everything stated has been general in nature and no restrictions have been made with the exception that the body be metallic in nature and be placed in an electrolytic solution. The basic ground work has been laid for the understanding of electro-osmotic flow.

In 1807 Reuss discovered that if an electric potential is applied to a porous diaphragm, the water moves through the capillaries towards the cathode; and that as soon as the electric current is switched off, the flow of water stops immediately. It was not until about 1880 that an explanation was made of the phenomenon, but this explanation given by Helmholtz stands to this day.

A small cylindrical capillary was filled with water and an electric potential was placed across the open ends of the cylinder making electrical contact with the water. The water again flowed toward the cathode (or negatively charged electrode) just as Reuss had noticed. Helmholtz was able to explain this action by using the theory postulated at the beginning of this paper.

The water was an electrolyte and the wall of the capillary contained metallic particles which interacted to cause the creation of a double layer of charged particles along the sides of the tube. The water flow toward the cathode meant that the positive layer was moving freely toward it. Since we know from our previous study that only the second layer is free to move, the moving positive layer must be the second layer. This would only be the case when the wall contained a less noble metal.

Subsequent testing has shown that almost all metals will act as the less noble case predicts; but in some extreme cases of pure noble metals and properly chosen electrolytes, the water flow can be reversed as the positive ion layer becomes rigid and the water goes toward the anode.

The moving second layer will carry along with it all of the free uncharged water molecules which make up the center portion of the capillary. This freely moving portion (the largest in volume) sees no resistance to its motion. The second layer motion however, is resisted by the rigid, first layer, but the resistance decreases with the distance away from the capillary wall. The

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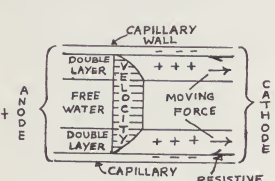
free molecules will all move at the velocity of that part of the second layer adjacent to them. This movement is called electro-osmosis or electro-osmotic flow.

Empirical studies of electro-osmosis have provided a formula by which one can predict the quantity of electrolyte moved in a unit time from a capillary. This expression is as follows:

$$q = \frac{ED r^2 \beta}{4 \eta L}$$

where all dimensions are cgs and electrostatic
E = applied potential
D = dielectric constant of the electrolyte
r = capillary radius
β = potential between rigid and movable parts of the double layer
η = viscosity of the electrolyte
L = capillary length between electrodes

From this point hence we will concern ourselves solely with electro-osmosis as it concerns practical applications in conjunction with soils.



ELECTRO-OSMOTIC FLOW THROUGH CAPILLARY WHICH BEHAVES AS A LESS NOBLE METAL.

The earth is a porous material and can be considered as a maze of small capillaries containing water. The capillary walls are made up of many different metals and metallic compounds. Since the less noble metals are quite abundant on the earth's crust in comparison to noble metals, in almost all cases, we will have the water flowing toward the cathode electrode. An exception occurs when the soil consists chiefly of calcium carbonate or chalk. Also, it has been observed that the interlayer potential difference is almost perfectly constant for most natural soils.

Thus as we scrutinize our empirical expression for volume flow per unit time we find our main variables to be "E" and "L" which together make up the potential gradient part of the expression (E/L). Tests run using most of the natural soils and clays showing the potential gradient versus discharge velocity from the capillary, show a linear relationship to exist. They demonstrate that for most soils found in nature a velocity of 1×10^{-4} cm/sec. develops for every 2 Volt/cm potential gradient.

Soil Stabilization

Soil stabilization is a topic dear to the heart of any civil engineer. All of his projects (dams, roads, buildings, etc.) must rest upon and be supported by the soil. He may even use the soil in his construction such as the foundation terrain used to support a railroad track. For such foundation work the soil must hold its shape and remain in place under great compression or weight. In civil engineering terms, the soil must be stable (able to support compression). Often the engineer cannot find a naturally suitable soil on the site of his project, thus he must find some manner in which to overcome this deficit.

The engineer may take three courses of action:

a) By-pass the undesirable soil
b) Remove the undesirable and replace it with desirable soil
c) Treat the soil present to improve it.

Of specific interest to us is the problem of a high water content in the soil. In such a case the soil will not withstand much compression and will flow or collapse away from any applied weight. It is quite time consuming and expensive to detour operations or to dig deeply to find substantial soil on which to place supports. The remove-replace method is equally bad. What then we ask, are methods of soil treatment available to obtain a stable soil?

1) Mechanical methods are typified by compaction where new soil mixtures are added and blended with those present until the desired water content is reached.

2) Thermal heating of the soil to 600°C will cause an irreversible dehydration to occur. Soil fusion by heating takes 1000°C to 2000°C and therefore is not practical.

3) Chemical treatments such as adding cement to the soil creating a mixture known as soil cement and adding tar or bituminous products are being used to form a strong soil base for support.

4) Miscellaneous methods of slope stabilization such as planting grass and trees for anchoring also help.

5) Electrical methods including electro-osmotic flow can be used to stabilize soils.

Thus we have electro-osmosis as but one of many methods available for the stabilization of soils, a problem that is very real and pressing to the civil engineer engaged in soil foundation construction.

—Continued on page 18

FOSSILS AND CLIMATE

by Robert M. Turner

When one hears of past temporal periods with their great changes in geography and life forms, one may ask, "What was the climate like then?" "Can 'they' figure out what it was like?" and "How do 'they' know?"

The answer is that man reconstructs the past with his knowledge of the present. He compares vestiges with present forms, and, with an assumption that chemical and physical laws have not changed, he can conceive fairly accurately the form of the entity and the environment of the period from which the vestige results. In this manner, man can use fossil evidence to describe past climatic conditions.

This paper will attempt to give some of the evidences of climatic periods, the climate that these evidences represent, and the reasoning behind this representation. Also, this paper will give a general picture of climate in North America during the Pennsylvanian period of the past using some of the methods described.

Among the best "indicators" of environment and climate are the rocks themselves. While the rocks are generally considered more a part of stratigraphy than of paleontology, for the purpose of this paper they will be considered as "fossils", both because of their significance as climate indicators, and because they are the containers of the animal and plant remains we study.

Sedimentary rocks usually reflect the environment in which they were deposited. These environments may be divided roughly into continental and marine environments with a third, mixed continental and marine environment, as a transition between the two major ones. A continental environment consists of deserts, piedmonts, valley flats, lakes, swamps and caves, as well as glacial areas. A marine environment is divided into shallow sea, intermediate sea, and deep sea areas. A mixed environment is one of lagoons, estuaries, deltas, salt marshes, and costal areas.

The most common rock types are conglomerate, sandstone, limestone, and shale. These are usually marine sediments but may be produced by all kinds of environments. Chert and flint, bedded iron, and green sandstone are characteristic marine sediments. Gypsum, salts, borax, and anhydrite are formed by warm, evaporating seas. Coarse sandstones with angular grains and grit are characteristic continental deposits. All of these types of sediments are found in the process of being deposited in these areas during the present time. Red sandstones and shales, or "red beds" show oxidation and are found in warm or tropical uplands. Dark grey or black sediments are indicative of water with poor circulation such as deep holes, swamps, and

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marshes. Peat and coal are also indicative of swamps. Marl is formed in lakes and tillite, varied sediments, coarse and scratched pebbles, and conglomerate formed of angular rocks, unsorted as to size, are found in glacial areas.

The fossil remains of plants and animals are generally classified as continental or marine in habitat. The reptiles, amphibians, mammals, insects, and plants other than seaweeds are usually continental. The mollusks, sponges, corals, starfish, seaweeds, and algaes are usually marine.

These fossils, when considered as having the same habits and requirements as modern forms, give an accurate picture of the conditions of their time. For example; amphibians live mainly in swamps, streams, or lakes. Reptiles and amphibians live mostly in warm areas. Mammals live mostly on land but in a wider range of environments. Radiolarians are deep sea creatures, clams, and starfish live in shallow water, and corals and sponges live in clear, shallow, and warm waters.

The Pennsylvanian Period

The Pennsylvanian period is a segment in the earth's history that began roughly 280 million years ago and has a length of approximately 45 million years. There is much evidence with which to reconstruct the climate of the period.

The period is characterized by a relative prominence of continental deposits consisting of coal, coarse to fine conglomerate, abundant and usually crossbedded sandstones, sandy to clayey (and usually dark) shales, and redbeds. These contain remains of land plants in many places and tracks of land animals less commonly. These deposits generally show a great variability from place to place especially as to the sequence of layers.

In the Eastern region, these deposits consist almost entirely of sandstones and shales with frequently interlieing beds of coal. Limestones from occasional marine invasions cover large areas but are generally very thin.

Coal also occurs in Illinois and the Midwest. These facts show the Eastern areas and the Central Interior to have been broad lowlands and swampy flats, sometimes inundated by marine waters and sometimes dry in places. Since plant remains must be preserved from decay (usually by the protective waters of a shallow lake, marsh, or swamp) if they are to become coal, the incredible number and extent of the coal beds indicate that these swamps existed over very large areas during most of the period.

These vast coal-forming swamps and the life they contained give the best indications of the life of the period.

The lush, fast growing, and widespread vegetative growth suggests a fairly warm and moist climate. The occurrence of tropical types of plants in high latitudes suggests mild temperatures. However, the temperature was probably not actually tropical, as present evidence indicates that peat forms best under temporate conditions, whereas very warm climates promote too rapid decay.

That there was a heavy and well distributed rainfall is indicated by the large cellular and over-all structure of the plant material. The aerial roots on some vegetation also indicates a high humidity.

The lack of growth rings suggests a lack of seasonal changes in climate, while the uniformness of plant types from area to area suggests a widespread uniformness of environment.

The usual plants found in these swamps are spore bearing and rhizoid plants which do not have true root systems capable of functioning successfully in dry soils.

Little is known of plants from higher ground. Perhaps the primitive conifers called cordaites, which are found occasionally in Pennsylvanian floras, were a bridge between the swamp plants and more advanced forms which may have lived on higher ground. These cordaites evidence a response to a demand for plants that could live on drier soil.

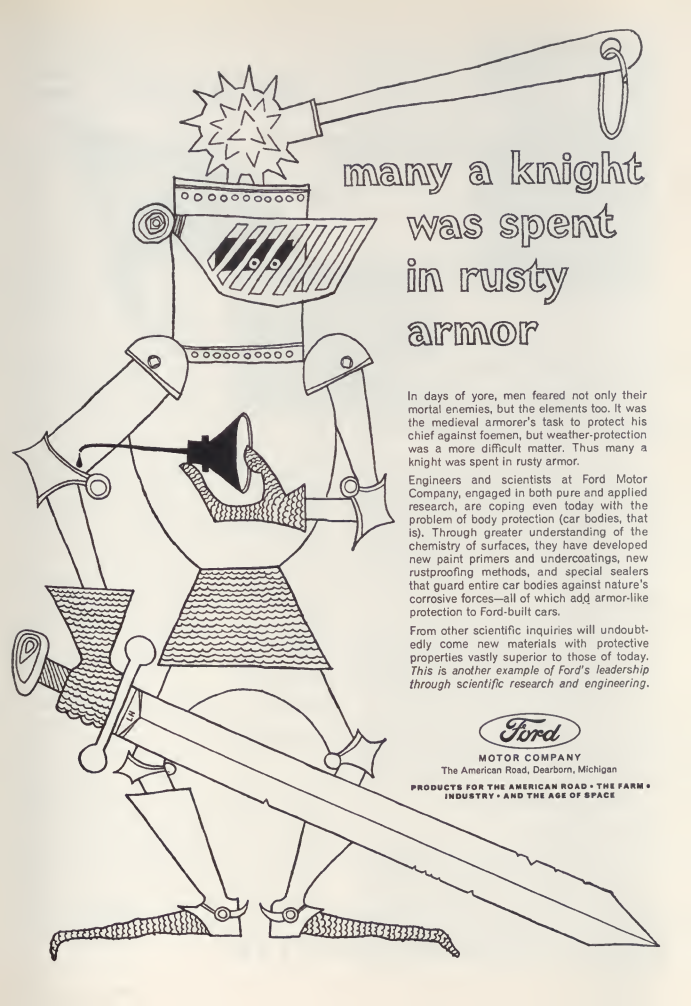
The numerous and very specialized amphibians and insects are indicative of the climate. Humid swamps, much rain, and no cold winters would be ideal for their propagation and the specialization and large sizes so apparent in these animals of the period.

Amphibians need swamps and bogs in which to live and reproduce, for even the forms that can live their adult life on land must have water in which to lay their eggs. The extent of a mild climate from the tropics to the Arctic is indicated by the northerly range of some of the amphibians which, being cold blooded, cannot survive freezing weather unless small enough to find suitable locations for hibernation.

At present, warmth seems to be related with insect size and the development of large forms. The Pennsylvanian swamps swarmed with varied insect life. There were countless numbers of dragonflies (500 known species) of which some grew to great size. Cockroaches, scorpions, centipedes, and spiders were common in the swamps.

There were undoubtedly local variations in climate. There is evidence of aridity in the central and western Colorado and the Utah areas. In this region are deposits of salt and gypsum along with redbed facies.

This, then, is the picture one gets of the Pennsylvanian climate from a study of its fossils.



many a knight was spent in rusty armor

In days of yore, men feared not only their mortal enemies, but the elements too. It was the medieval armorer's task to protect his chief against foemen, but weather-protection was a more difficult matter. Thus many a knight was spent in rusty armor.

Engineers and scientists at Ford Motor Company, engaged in both pure and applied research, are coping even today with the problem of body protection (car bodies, that is). Through greater understanding of the chemistry of surfaces, they have developed new paint primers and undercoatings, new rustproofing methods, and special sealers that guard entire car bodies against nature's corrosive forces—all of which add armor-like protection to Ford-built cars.

From other scientific inquiries will undoubtedly come new materials with protective properties vastly superior to those of today. *This is another example of Ford's leadership through scientific research and engineering.*

Ford

MOTOR COMPANY
The American Road, Dearborn, Michigan

PRODUCTS FOR THE AMERICAN ROAD • THE FARM • INDUSTRY • AND THE AGE OF SPACE

WHAT'S NEW

Edited by Harvey Flatt

SATELLITE "ECHO SUPPRESSOR"

An electronic device designed to solve one of the basic problems which would arise in space communications was introduced recently by scientists of General Telephone & Electronics Corporation.

Known as an "echo suppressor", the device is designed to "silence" echoes which would occur in telephone conversations between widely separated parts of the world, using a space satellite as a relay station. The device was displayed at the Global Communications Symposium (GLOBECOM), sponsored jointly by the American Institute of Electrical Engineers and the Institute of Radio Engineers.

Echoes Render Conversation Unsatisfactory, or Even "Worthless"

According to Dr. Herbert Trotter, Jr., President of General Telephone & Electronics Laboratories, telephone communications employing a satellite system would be unfeasible unless such an echo-reducing device were part of the system. He pointed out that the echo of an individual's voice, while not rendering speech completely unintelligible, would have the "inevitable effect of leading the speaker to enunciate too slowly and jerkily, and would interrupt trains of thought, thus resulting in unsatisfactory or even worthless conversation." However, the "echo suppressor" would enable a satellite system to carry "natural telephone conversations".

Two Modes of Operation

Dr. Larry Hunter and James Stewart, inventors of the device, described the "echo suppressor" as being capable of operating in two "modes".

In "mode 1" there is complete echo suppression while one person is "doing all the talking" without interruption from the person on the other end of the circuit. An open switch breaks the circuit in the non-used direction of transmission so there is no path by which the echo may return to the talker.

"Mode 2" becomes operable in the device—automatically and not noticeable to the talkers—when one person is talking and the other person interrupts. In "mode 2", "partial echo suppression is achieved by inserting 'loss', or attenuation, in the transmission paths. If the same amount of 'loss' is inserted in each path, the echo suffers twice as much loss as the signal, and therefore, with a reasonable amount of 'loss', the echo becomes unnoticeable while both speakers are talking". In this "mode", the switch must be closed to permit transmission in both directions at the same time. Closing the switch makes it possible for the echo to return to the talker. To reduce the effect of this echo, "loss" is introduced by electronic methods of control.

Emphasizing that the "echo suppressor" still is in the developmental stage, the two scientists said their work with the device indicates that "with partial echo suppression during interruptions and with complete suppression for normal conversational interchange, high quality telephone service by means of satellite systems will be possible".

Adaptable to Low and High Altitude Systems

The complex device could be adapted to either low-altitude or high-altitude satellite systems, and also to long-range land-line systems.

The high-altitude system would have three or four synchronous satellites placed equidistant around the equator, each at an altitude of 22,300 miles and orbiting at the same angular velocity and in the same direction as the earth's rotation. The satellites would be "stationary" in that they would remain over the same point on the earth's surface. Because the satellites would be stationary, each ground station with its fixed antenna would constantly be in "line of sight" with one of the satellites. The ground stations would transmit signals to the satellites which in turn would relay the signals to ground receiving stations located throughout the world. At least 20 ground

—Continued on page 22

• One in a series of messages on how to plan your career

What kind of engineers make steel?

The answer is mechanical engineers, chemical engineers, electrical engineers, mining engineers, industrial engineers, civil engineers, and, of course, metallurgical engineers. There are others, too, but our listing covers the ones most frequently encountered.

It's a common misconception that college-trained metallurgists dominate the steel industry. Not so. *Every* major engineering degree is represented within the management ranks of a steel company.

It makes sense. The mining and processing of minerals obviously suggests the need for Mining Engineers. Then come the chemical processes of coke-making, smelting, refining. Fuels are consumed, valuable by-products are made. Is it any wonder steelmaking calls for Chemical Engineers?

And how about the machinery, the mills, the furnaces, the instrumentation that make up a modern steel plant? Mechanical Engineers design them, and frequently supervise installation. Civil Engineers design and put up the buildings to house them, and the feed lines to keep them supplied.

Power? Steel is the biggest industrial consumer of electric power. You cannot conceive of a greater concentration of electrical equipment than in a modern steel mill. And many steel plants *generate* electric power, too. Electrical Engineers are busy fellows in the steel industry.

Steelmaking calls for volume production, complex and scientific, often highly automated. Steel companies make numerous finished products, too, from nuts and bolts to nuclear-powered cruisers. The Industrial Engineer finds

plenty to do around steel.

What's more, the above comments fail to make perhaps the most important point—interchangeability. We have found that there are endless opportunities for men with any one of the engineering degrees we have mentioned to handle jobs entailing great responsibility. The supervisor of a huge open-hearth department, or a giant rolling mill, might well be an M.E., a Ch. E., a Met. E., an I.E., or C.E.

Sales Engineers—Because of the nature of our products, Bethlehem salesmen are best equipped when they, too, are engineers. For a man with a technical background and a "sales personality," there are splendid opportunities with Bethlehem Steel.

Shipbuilding—As the world's largest privately owned shipbuilding and ship repair organization, Bethlehem offers careers to Marine Engineers and Naval Architects, as well as to engineers in many other categories.

The Loop Course—This program was established some 40 years ago, to select and train well-qualified college graduates for careers in the Bethlehem organization. It was so named because of an observational circuit (or "loop") of a steel plant. After a five weeks' basic training period, which is held once a year at company headquarters, in Bethlehem, Pa., loopers receive their first assignments, which call for specialized training that may last for a few weeks or for as long as a year. Next comes on-the-job training, and the looper is on his way.

Big and Diversified—Because of its size and diversity, Bethlehem Steel offers unlimited opportunities to "get ahead." One of the nation's largest industrial corporations, with over 140,000 employees, we are engaged in raw materials mining and processing; basic steelmaking and the production of a wide range of steel products; manufacturing; structural-steel fabricating and erecting; and shipbuilding and ship repair. A new centralized research facility, the Bethlehem Steel Company-Homer Research Laboratories, costing in excess of $25 million, located in Bethlehem, Pa., rivals the finest in any industry.

Read our Booklet—The eligibility requirements for the Loop Course, as well as a description of the way it operates, are more fully covered in our booklet, "Careers with Bethlehem Steel and the Loop Course." It will answer most of your questions. Copies are available in most college placement offices, or may be obtained by writing to Manager of Personnel, Bethlehem Steel Company, Bethlehem, Pa.

All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

Steel

BETHLEHEM STEEL

BETHLEHEM STEEL

MECH MISS

Sabina von Zahn

This month's Mech Miss is a lovely 20 year old sophomore. Sabina was born in Germany, but now makes her home in Arlington, Virginia, while studying speech at George Washington.

Sabina's interests extend to many areas besides speech. These include painting, acting, music, horses and swimming. She is a member of Sigma Kappa.

For those interested in other types of statistics, Sabina is 5' 9" tall, has blue eyes and reddish blond hair.

By the way fellows, she said that she would like to meet more engineers.

ASCE

ALUMNI PAGE

Edited by

John Wolfgang

The Mecheleciv Staff welcomes current news concerning the engineering alumni of George Washington University. Alumni this is your information service about former classmates. Please let them know what you are doing.

Hugh S. Wertz BEE '29 was elected Section Chairman by the Northern New Jersey Section of the Institute of Radio Engineers.

Robert M. Moore BSE '59 is back at George Washington University as an instructor in Electrical Engineering.

Arnold Lee Snyder, Jr. BCE '60 is currently doing graduate work in meterology at the MIT Air Force Institute of Technology.

Charles A. Burner BCE '30 retired from government service in 1957 and now resides in Eau Gallie, Florida.

Irwin W. Tucker BSE '39 after graduating from George Washington completed Ph.D. work in chemistry at the University of Maryland. Mr. Tucker is currently self employed as a consultant in Louisville, Kentucky.

William D. Johnston III BSE '60 is currently doing graduate work at the University of Munich, Munich, Germany.

Robert G. Russell BME '60 is now process engineer for General Motors, Delco Remy Division, Anderson, Indiana.

Donald O. Baechler BEE '60 is reliability studies engineer at ARINC Research Corporation, Silver Spring, Maryland.

Arthur Machlin BEE '49 is an Electronics Engineer with the Voice of America, USIA.

Rear Admiral Benjamin Katz USN Ret. MEA '58 is now head of systems division of TMC Systems Incorporated, Alexandria, Virginia.

Richard Lee Potterton BSE '60 is currently a mathematician with the National Security Agency, Washington, D. C.

Steve Reymer BSE '60 completed the Bethlehem "loop Course" Program, married a Bethlehem, Pennsylvania lassie, and is now a product salesman in Philadelphia, Pennsylvania.

Ross Pressley Strout MS '50 is currently an Associate Professor of Mechanical Engineering at the University of Illinois.

Edward H. Pendergast BME '51 is now group supervisor for the Hercules Powder Company at the Allegany Ballistics Laboratory, Piedmont, West Virginia.

Lee R. Schermerhorn BSE '35 is self employed as a patent lawyer in Portland, Oregon.

James J. Crenca MEA '55 is Administrative Director of Research and Engineering, Jamsky and Bailey Division of Atlantic Research, Alexandria, Virginia.

Richard H. Welles BCE '52 is manager of Specifications Branch, Bureau of Yards and Docks, Washington, D. C.

Woodrow W. Everett, Jr. BEE '59 is a communications officer with the United States Air Force.

Joaquin L. Panis BCE '25 is now Chairman of the Board, National Development Co., Republic of the Philippines.

WHO is at work on a satellite system for global telephone and TV transmission?

WHO provides the communications channels for America's missile defenses?

WHO is girdling the globe with communications for America's first man into space?

WHO tapped the sun for electric power by inventing the Solar Battery?

WHO used the moon for two-way conversations across the country?

who?

WHO guided Tiros and Echo into accurate orbit?

WHO made your pocket radio possible by inventing the Transistor?

WHO maintains the world's largest, finest industrial research facilities?

WHO supplies the most and the best telephone service in the world?

WHO has the UNIVERSAL communications organization?

THERE'S ONLY ONE ANSWER TO ALL TEN QUESTIONS

BELL TELEPHONE SYSTEM

Pioneering in outer space to improve communications on earth

TECH NEWS

Edited by Larry C. Hice

MOLECULAR SLIDE RULE

Scientists at the Westinghouse research laboratories have demonstrated a unique electronic device which might best be described as a "molecular slide rule." The tiny device electronically performs multiplication and division by a process similar to that used in the familiar mechanical slide rule so widely used for mathematical calculations.

Yet the new multiplier-divider has no conventional electronic components or circuitry.

It is simply a solid slice of silicon about the size of the head of a thumbtack and as thick as a few sheets of paper.

The molecular slide rule is the latest subsystem, or functional electronic block, to be demonstrated by Westinghouse through the principle of molecular electronics.

Molecular electronics is a promising new approach to electronic systems.

It does away with traditional circuits built from arrays of electronic components such as tubes, transistors, resistors, and the like.

Instead, the same function is performed by rearranging the internal structure of a solid semiconductor crystal. Electronic behavior occurring within or between regions in the crystal gives the same effect as an entire electronic circuit (subsystem), or even a whole system.

The multiplying and dividing function performed by the new functional block is equivalent to that done by an array of four separate diodes, or three diodes and a transistor. The functional block, however, is capable of greater accuracy than the assembly of individual components.

Westinghouse previously has announced some 20 other functional electronic blocks capable of performing a dozen different kinds of electronic functions.

The new functional electronic block multiplies by adding together voltages that are logarithms of the quantities to be multiplied. The logarithm of a number is the power to which a fixed base number (usually 10) must be raised in order to equal the number (called the antilogarithm).

A slide rule is marked off in logarithmic scales and is labeled with the corresponding antilogarithms. To multiply two numbers, the sliding and fixed scales are adjusted to add their logarithms. The product or antilogarithm, is then read directly from the instrument.

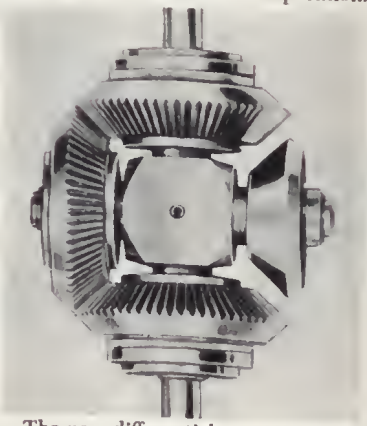
The molecular slide rule performs in a similar way, but electronically by means of semiconductor junctions. An electric current fed into a junction gives a voltage across the junction proportional to the logarithm of the current. An input of two currents into two junctions gives a voltage which is their logarithmic sum. The antilogarithm, measured at the output of the functional block, is the product of multiplying them together.

Just as in a slide rule, division is the opposite process. The currents are fed into the multiplier-divider in such a way that their two logarithms subtract instead of add.

Used for multiplication or division, the new device has an input range of 10 to one and an output range of 100 to one. Its accuracy in multiplying, dividing is within five percent.

PRECISION DIFFERENTIAL

A new line of precision balanced instrument differentials, designed especially for computers and control instruments of all kinds, has been announced by Instru-Lec Corporation.



The new differentials provide clearance circles down to ½ inch or less, thus minimizing space requirements. Except where aluminum spider gears are specified, the differentials are made entirely of stainless steel. Each unit employs six miniature ball bearings which conform to ABEC 7 tolerance specifications.

Backlash is held to 8 minutes or less as required, break-away torque from 0.1 to 0.3 ounce-inches depending on size, and balance is maintained at all times. Units are available with 0.0779, 0.0935, 0.1248, 0.1873, or 0.2498 inch diameter shafts with overall lengths up to six inches. Differentials are made in wide (miter gear) version and in narrow (½ width) design. End gears are secured to the shaft with true lock serration and are made from flat blanks that are parallel within 0.0002 inch.

The company also makes sub-miniature precision differentials and precision hollow-shaft differentials (narrow and wide) as well as fine pitch high-precision gears of all types in experimental and production quantities. □

—Continued on page 19

Gyron—dream car that drives itself. This two-wheeled vehicle of the future envisions automatic speed and steering control for relaxed "hands-off" driving. Designed by the advanced stylists of one of America's leading automotive companies, the delta-shaped Gyron would feature a computer that permits motorists to "program" their journey—distance, speed, arrival time—on a non-stop expressway. A gyroscope would stabilize the car in motion. Setting off the Gyron's sleek lines are parts coated with bright, corrosion-resistant nickel plating. The front bumper, exhaust ports, taillight bezel, control console, all get solid beauty-protection with this durable nickel coating system.

How Inco Nickel helps engineers make new designs possible and practical

The engineer is vitally concerned with design—inside and outside—whether it's an advanced new car or a nuclear-powered ship. With Nickel, or one of the many metals containing Nickel, he has a material that can meet the demands of a wide range of service conditions—providing an excellent choice for the equipment of today and the designs of the future.

Inco's List "A" contains descriptions of 200 Inco publications which are available to you, covering applications and properties of Nickel and its alloys. For List "A", write Educational Services.

The International Nickel Company, Inc.
67 Wall Street, New York, N. Y.

The Nuclear Ship Savannah is capable of sailing 350,000 nautical miles without refueling. Her uranium oxide fuel is packaged in tubes of Nickel Stainless Steel, more than 5,000 of them. Engineers specified 200,000 pounds of Nickel Stainless Steel for use in the ship's reactor to meet critical service demands.

Monorail "Airtrain"—a compact, high-speed transportation system that will be automatic, almost noiseless. Development is being explored by leading U.S. cities. Lightweight Monorail design demands strong weight-saving metals. Logical choice: Nickel alloys to take advantage of newest engineering concepts.

INCO **INTERNATIONAL NICKEL**

The International Nickel Company, Inc., is the U.S. affiliate of The International Nickel Company of Canada, Limited (Inco-Canada)—producer of Inco Nickel, Copper, Cobalt, Iron Ore, Tellurium, Selenium, Sulfur and Platinum, Palladium and Other Precious Metals.

Practical Applications of Electro-Osmosis for the Stabilization of Soils

We will now examine some of the first experiments in the application of electro-osmosis for soil stabilization. The first instance was in Salzgitter, Germany during 1939. The Nazis were building a railroad and wished to place the track 20 feet above the surrounding land by digging the land away from around the track foundation soil. After excavating the cut about 6 feet, all work was forced to a halt as flow slides brought the water-soaked soil along the sides down into the bottom of the cut. An ooze formed in the bottom that impaired the workings of all the heavy digging equipment as well as the human laborers.

Dr. Leo Casagrande, a German who had been studying electro-osmosis for three years began an experiment along a 300 foot section of the excavation. He spaced his anodes and cathodes alternately at 15 foot intervals on both sides of the cut. For cathodes he used 4-inch steel pipes with small holes in their sides, whereas 1/2-inch gas pipes served as anodes. The pipes were driven 22.5 feet into the ground.

SITUATION EXISTING IN RAILROAD EXCAVATION

A potential of 180 volts was applied, causing electro-osmosis to take place. The water arriving at the 4-inch cathode pipes seeped into them through the holes in their sides and was removed by a pump. After a delay of only three hours the workmen were able to resume the work using hand shovels. After one or two days the heavy equipment was able to work inside the cut again. The slopes of the excavation were stable no matter how steep the cut, once electro-osmosis was applied.

Due to this success, the method was used for completion of the entire project. The voltage was reduced to 90 volts in order to conserve the energy used. The power needed initially upon application was 1.7 kilowatts per cathode which finally dropped to 1.2 k.w. after about two weeks use. This amounts to a 18.8 amps per cathode to 13.3 amps per cathode. The total energy consumption for the project was 1.0 kilowatt hour per cubic yard of excavation.

Upon completion of the project using electro-osmosis, the sides of the cut were covered with a sand and a drainage pipe was laid in the bottom of the ditch to protect against future seepage after the discontinuation of electro-osmosis.

An important effect was noticed in this first application. Immediately after the voltage was applied to the electrodes, the sides of the cut improved to such an extent that there were no flow slides as the men began to work. There is an interesting explanation for this. The electrodes had not only begun removing the water within their immediate vicinities, but also attracted the water of the surrounding areas to fill in the vacancies created as the water was removed from the soil between them. This force of attraction toward the cathode area, although it didn't remove the water from the soil immediately, counteracted the gravitational forces that tended to pull the water-soaked soil down into the ditch. Thus the sides of the cut were held in a state of suspension until enough water content was removed to enable the soil to be stable without the aid of electro-osmotic. Therefore electro-osmotic flow, not only removes water content from the soil, but also stabilizes that water remaining in the soil.

A second project was attempted when it became necessary to build a bridge across the railroad. Since the conditions of the soil were the same as those described above, Dr. Casagrande was asked to try his method again. For the bridge foundation, a hole 20 feet deep, 25 feet wide and 50 feet long was needed. The same method was adopted as before. The electrodes were placed 25 feet deep at intervals of 13 feet and 90 volts again was applied from anode to cathode. After a waiting period of one week the work of excavation was begun. There were no incidents of

—Continued on page 22

TECH NEWS—Continued from page 16

NEW COLOR PERCEPTION THEORY

A new theory of human color perception which represents the first complete mathematical formulation of the behavior of any of the human senses was announced recently by Gene K. Beare, President of Sylvania Electric Products Inc.

Mr. Beare said the theory is likely to have major impact in a wide variety of applications where color is utilized—such as photography, television, data display systems, and meteorological satellites and other space surveillance vehicles.

Color-Vision Theory is "Exciting" New Concept

The color-vision theory is "one of the most exciting developments, if not the most exciting new concept," in this area of investigation, Mr. Beare said. He described the theory as "the first of what we hope will be a long series of mathematical descriptions of human perceptive processes."

"As with initial formulation of any new theory, the work of application is just beginning. History has shown that a good many years must be spent in working out its application to the myriad of areas where it can be useful. For example, it took more than 40 years to achieve the atomic bomb following Einstein's formulation of the theory of relativity."

Referring to "color-blind" meteorological satellites, Mr. Beare said the addition of color perception to the capabilities of such satellites would enable them to provide certain types of information, of extreme importance to many space programs, that otherwise would be unavailable.

Color data from a sensory device in the satellite can now be processed in a manner similar to the way the human eye treats the information. Thus, it would be possible to identify the true color of an object regardless of the nature of the illumination it receives. This interpretation of color data may help in distinguishing cloud cover from land masses when viewed from a satellite.

The new mathematical theory, first to describe the processes that occur during ideal human perception of color, was formulated at the Allied Research Laboratory of Sylvania Electronic Systems. It was developed during studies of man's sensory perception and thought apparatus, studies that were directed toward linking man to advanced communications systems. The color-vision theory was formulated by Dr. Huseyin Yilmaz, a research physicist and a member of the information processing department at the Applied Research Laboratory.

Areas of possible future application of the theory are indicated by the achievements of the National Aeronautics and Space Administration's TIROS series of meteorological satellites in early detection of hurricanes which "have shown that such satellites can be very beneficial in predicting weather from both the military and civilian viewpoints, yet, such satellites are completely color blind. That is, they sense only black and white. If such satellites could utilize chromatic or color information, they would be much more sensitive to meteorological variations. Another dimension would be added."

Mr. Beare said the application of color detection has been hampered by the fact that the sensory apparatus of such satellites must operate in orbit under both daylight and night-time conditions. "Thus, in order to detect color, a capability almost human in nature—which does not depend upon light conditions for a wide range of natural illuminations—is required."

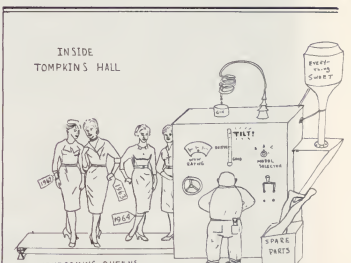
"With the mathematical theory of color perception now available to us the construction of a sensory device which would allow us to detect color within the TIROS field of view over most of its circuit around the world appears within the realm of practicality."

Old Product — New Container

A newly designed stainless steel beer barrel has made its way to the market place and is expanding the use of the shiny metal in this age-old custom of carrying beer in barrels.

Expanded rolling rings, which resist impact and distribute shock throughout the barrel, are a distinctive feature of the 15½-gallon barrel.

After the barrel is completed, it can expect a life of more than 25 years in carrying about 1620 gallons of what the thirsty man calls a tall, tangy, satisfying drink, to market.



CAMPUS NEWS

Well, this month passed busily with the usual round of classes, meetings, and activities. Speakers and films were the order of the night at the meetings of the student branches of the professional societies. The members of ASME viewed an excellent film released by the Atomic Energy Commission on the control of plasma in fusion reactors. The ASCE members heard an interesting lecture by Thomas W. Reichard who is a Structural Research Engineer at the National Bureau of Standards. His lecture was given on "Lightweight Aggregate Concrete" which is the concept of using an aggregate of volcanic ash instead of sand or similar material. This provides an equivalent amount of strength with much less weight. The AIEE-IRE provided two films for its members from the Bell Telephone Laboratory: "Crystals" and "Introduction to Solid State Physics." The societies always have a good program and are deserving better attendance.

The professional branch of the AIEE recently held its student night and it was well attended. Dr. C. H. Page, Chief of Electricity Division of the National Bureau of Standards, reviewed the definitions of measurements, and the development of precise measurements at the National Bureau of Standards. He also discussed the main purpose of the National Bureau of Standards in devising means for making precise measurements. After Dr. Page's speech, the audience was separated into small groups which toured five laboratories. Among those open were the following: thermionic diodes lab, high-voltage lab, servo-mechanisms lab, magnetic materials lab, and the microwave lab.

Floyd Mathews appointed Herb Wilkinson and Moffett Tharpe Jr. as graduate representatives to the Engineers Council. Recently Floyd was honored to receive the Annual Fall Award from the National Capitol Section of the American Society of Civil Engineers. The award was given in recognition of notable contribution of his chapter of ASCE and his scholarship and commendable personal attitudes. The award was presented at the November dinner meeting of the society.

—Continued on next page

Sigma Tau announced its new pledge class composed of John Colarco, Robert Hirsch, Erling Jacobsen, Douglas Jones, Lee Kaminetzky, Donald Miller, Mendel Peterson, Edward Sebol, Faith Smith, Clifford Stearns, and William Whitesell. Dan Kohr who was the president of Sigma Tau unfortunately had to resign because of the ill health of his wife. His place will be taken by Arthur Macurdy, who was serving as vice-president.

On October 25 the Engineers Council held a mixer in Tompkins Hall Room 200. Dr. Lawrence P. Leite presented a very interesting talk on "Science Reflected in Modern Art". He showed slides and added a very interesting commentary.

On November 11 Theta Tau held its annual shrimp feast at the home of brother Ray Morales. Food was plentiful and all who were there had a very enjoyable time. The brothers contrived a very interesting game somewhat like basketball except that a tire hanging from a tree provided the goal. This provided entertainment while energy could be sustained since it turned out to be somewhat a combination of football and basketball. John Wolfgang and Dan Havens were seen to be having a grand time on the swings provided for Ray's children.

For the second year the Engineer's Council built the float for the Homecoming Queen and her court in the homecoming parade. Harvey Flatt, Chairman of the Homecoming Float Committee, and John Wolfgang, who designed and helped greatly in building it, deserve many thanks for their effort. Thanks also to those who helped in other ways to make it a success. Queen Rollie and her court looked very pretty decorating the background of a football field and gigantic helmet.

SOIL STABILIZATION THROUGH ELECTRO-OSMOSIS—Continued from page 18

soil movement or flow, but each cathode drew 15.5 amps or 1.4 kilowatts. The energy used for the project was 8 kilowatt-hours per cubic yard of excavation.

In this case, the method was 8 times more inefficient than before. The explanation for this was the fact that a much smaller volume was removed causing a waste of energy drying out more soil than necessary, whereas before we had a long strung out project with a large volume of removal creating a smaller amount of energy waste in proportion to soil excavated. This is the theory behind mass production, where a larger scale operation actually creates better efficiency.

A third application of interest came about during the Nazi construction of a U-boat pen in Norway by the sea shore. The construction was begun in the normal manner as a large plate of sheetpiling was sunk 65 feet into the ground around the digging and reinforced. The pit was desired to be 46 feet deep. But just as 23 feet was reached the sheetpiling failed, the pit began to fill with water. In desperation Dr. Casagrande was called in to eliminate the problem.

Cathodes of slotted 8-inch pipes were sunk 60 feet into the ground at 30 foot intervals. Anodes made of ordinary gas pipes were spaced between the cathodes and 40 volts of potential was applied. In two days, even the heavy machinery was in action continuing the work. The job took 6 months but only 0.4 kilowatt hours per cubic yard was consumed. This was attributed to the tremendous amount of soil removed from the pit. An interesting note was that the seepage of sea water into the soil was so great that the water content of the soil during electro-osmosis decreased only 1/2 per cent.

Thus the basic ground work of the development of electro-osmotic flow has been laid. It remains for the modern engineer to figure out a method of application in which its efficiency can be increased. It may well be that the electro-osmotic phenomenon can be applied to some other fields of application to a much higher degree of efficiency. Many such challenges face the young electrical engineer today. Electronics is at present a glamorous field of unlimited opportunities and applications, but we must not forget that there are many other aspects of electrical phenomena yet unexplained, unexplored, and certainly unexploited. It is our responsibility to ourselves, our nation, and our profession not to neglect any such seemingly insignificant effects like electro-osmosis in our attempts to advance a science which is presently enamoured with electronics and space.

SATELLITE "ECHO SUPPRESSOR"—Continued from page 10

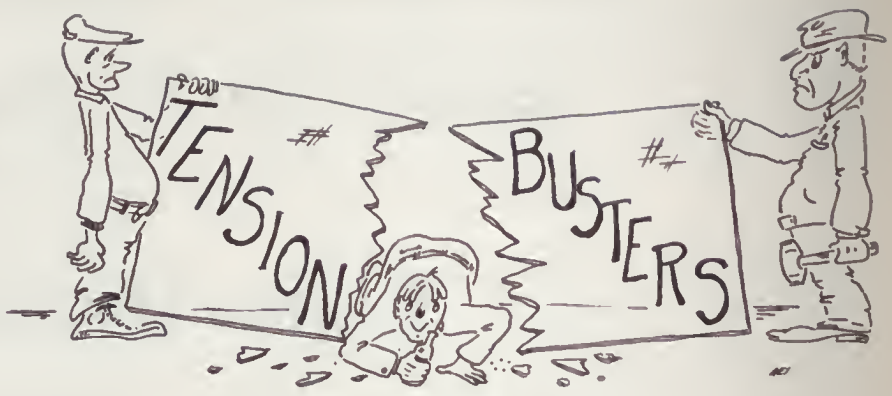
stations would be required for world-wide coverage, although the exact number would depend on the availability of suitable ground communications in various sections of the world.

The lower-altitude system would use 40 or more satellites launched into random polar orbits about 3,000 miles high. Because they would be in random orbits not paralleling the direction of the earth's rotation, the individual low-altitude satellites would not be in constant contact with any single ground station. As a satellite passed out of a ground station which was transmitting via the satellite to another ground station also in line of sight of the satellite, both stations would rotate their antenna to establish contact with an oncoming satellite. This switching process would require equipment capable of solving mechanical and electrical problems not present in a high-altitude system with its fixed line of sight between satellite and ground stations.

NAME THE BUILDING CONTEST

This building was Draper Hall and was used for various engineering classes before Tompkin's Hall was constructed. Draper Hall faced on G street between 22nd and 23rd street on the lot on which now stands Tompkin's Hall. Donald C. Lokersan of Chevy Chase, Maryland was the first student to correctly identify Draper Hall and he will recieve one free ticket to the Engineer's Ball which will be held on February 24, 1962.

KEEP CALM!



DON'T LOSE YOUR HEAD

His toes curled in the black soil. It was marvelous to feel the good cool earth beneath his feet again. Tenderly he bent down and crumbled a piece of sod between his fingers. A man was a fool to leave the land. He thought of the city with loathing. All it had him was unhappiness and sorrow, but that was over. He was back to his first love--the earth. For a while he was motionless in silent contemplation; a prayer of thanksgiving rose from his heart. Once more he was part of nature and not just a shadow in the city. A voice called, "Dinner's ready." Slowly and reluctantly he took his foot out of the flower pot.

Concluding his lecture a college professor started to dismiss the class when a student called out: "Professor, have you any documentary proof to support the things you've been telling us?"

Since the talk had been about life on other planets the professor admitted that he hadn't any proof.

"Until you do produce proof," said the student, "do you mind if I call you a liar?"

"Not at all. Tell me, were you born a human or an animal?"

"A human, of course."

"Have you your birth certificate with you?"

"No, but--"

"Well, until you produce it, do you mind if I call you an impertinent jackass?"

And then there was the inebriated EE who was arrested for feeding the squirrels in the park. He was feeding them to the lions.

She: "I'm perfect"
He: "I'm practice"

Dear Friend:

This letter was started in Peoria in the hope of bringing relief and happiness to tired husbands. Unlike most chain letters this one won't cost you any money. Simply send a copy of this letter to five of your best friends who are equally tired. Place your name on the bottom of the list and then bundle up your wife and send her to the next man on the list. When your name comes to the top of the list you may receive anywhere from 16-178 women and some are DANDIES.

Have faith--Don't break the chain.

One man broke the chain and got his old woman back.

P.S. At the time of writing this letter a friend of mine received 365 women. They buried him yesterday and it took three undertakers thirty-six hours to get the smile off his face.

A Friend

Ali Khan
King Farouk
Herb Wilkinson
Artie Shaw

"Carry your bag sir?"
"No, let her walk."

Tourist Guide: "We are passing the largest brewery in the United States."

C.E.: "Why?"

A girl and the engineer were listening to a chimes recital.

"Beautiful, aren't they?" said the girl.

"Pardon," he inquired.

"I say, they're beautiful, aren't they?"

"I'm sorry," he roared, "but I can't hear a thing over those lousy bells."

Found on fall registration card of freshman engineering student: NAME OF PARENTS--Mommy and Daddy.

Once upon a time a beautiful girl was walking through the woods when she came upon a poor little frog who spoke as follows: "Lovely princess, once upon a time I was a handsome prince but a big black witch turned me into a frog."

"Oh, that's terrible," said the beautiful girl. "Is there anything I can do to help you?"

"Yes, indeed," replied the frog. "If you will take me home with you and put me on your pillow, I will be saved."

So the beautiful girl took the poor little frog home with her, and the next morning when she awoke there beside her was a handsome young prince. And, do you know, to this day her mother still doesn't believe that story.

A German was the guest of a Frenchman who asked him how they distinguish between an optimist and a pessimist in Germany.

"It's very simple," replied the German. "The optimists are learning English and the pessimists are learning Russian."

Know the difference between a psychotic and a neurotic? The psychotic thinks that two plus two is five. The neurotic knows that two plus two is four--and hates it!

Kodak beyond the snapshot...

(random notes)

A little x-ray news

More precious than rubies is confidence in the importance of what one does for a living. One thing we do for a living is to manufacture x-ray film. Unkind words are rarely spoken about society's need for x-ray film. Now we have news about x-ray film and need to make it seem important. Easy.

The first piece of news has it that Kodak x-ray film of high contrast and fine grain is now obtainable with emulsion on one side only. Ties in to the current push for great structural strength in small mass. Load-bearing members are now getting so thin that putative flaws on their radiographs have to be checked out with a microscope. Since a microscope can focus on only one side of the film at a time, it's better to have the other side blank. Simple, yes; trivial, no. Manufacturing and distribution problems on our scale are rarely trivial.

The second piece of news much exceeds the first in importance. You have been given estimates by various authorities of how much radiation you and your children can expect to soak up, barring disaster. You have been told how much to figure for medical and dental radiological examination over a lifetime. Meanwhile we have been quietly goofing up the statistics! We have been upping the response of the films. With the latest step, the same amount of examination requires half or a third as much radiation as before. Just privately rejoice a little at how the deal has been sweetened a bit for you, statistically.

To John!

We are not alone in polypropylene. Seven other large and reputable companies are known to be playing in the game against each other and us. All we players must be very brave, hide our nervousness, and raise our glasses high in a toast to the memory of Senator John Sherman, who believed in the great public good that comes of free and untrammeled competition.

(Other nations have ambitious polypropylene plans of their own and are outproducing the U.S. in polypropylene right now in the aggregate. The peoples of the earth had better start making their artifacts out of polypropylene—and fast!)

As the game gets under way, we hold certain strong cards. Our Tenite polypropylene

- Can be polymerized from propylene by two completely different processes of our own devising, both free and clear of the U.S. patents of others.
- Comes in many flow rates.
- Comes in the widest variety of reproducible colors.
- Is exceedingly well fortified by our own antioxidants against oxidative deterioration.
- Has "built-in hinge," i.e. tremendous fatigue resistance under flexure.
- Weathers very well when extruded in monofilament for webbing and cordage, because of our own ultraviolet inhibitors.
- Has high-enough softening temperature so that when it is extruded as sheet you can cook in it and yet on a yield basis it costs less than cellophane.

A familiar force

Here is a picture of the basic amplifier used in photography. This amplifier can provide a gain of 10⁹. There is a genie in the bottle. Familiarity with him breeds not contempt but admiration.

Once upon a time, it was customary to summon the genie by retiring to a little darkroom and pouring him out of his bottle into a white enameled tray. No longer does he demand such ceremonious treatment.

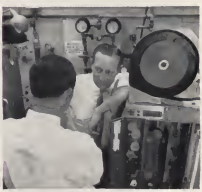
Our wet friend now works unseen inside a box, responding to push buttons. His very fluidity has been replaced by a kind of viscosity which need little concern the client, who merely inserts a probe into a disposable cartridge. When the work is done, the genie uses his private exit to the sewer.

This newly announced Eastman Viscomat Processor does 36 feet of 16mm film per minute. Not entirely by coincidence, this happens to be the rate at which film runs through a projector. The film spends about one minute in the processor. It emerges processed to standard commercial quality, ready to project. It can be stopped for seconds or days and restarted without loss of quality. Were we not so touchy about processing quality, the gadget would have been on the market long before.

Note: Whether you work for us or not, photography in some form will probably have a part in your work as years go on. Now or later, feel free to ask for Kodak literature or help on anything photographic.

X-RAY FILM NEEDS GOOD PEOPLE

POLYPROPYLENE NEEDS GOOD PEOPLE



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Interview with General Electric's Dr. J. H. Hollomon

Manager—General Engineering Laboratory

Society Has New Needs and Wants—Plan Your Career Accordingly

DR. HOLLOMON is responsible for General Electric's centralized, advanced engineering activities. He is also an adjunct professor of metallurgy at RPI, serves in advisory posts for four universities, and is a member of the Technical Assistance panel of President Kennedy's Scientific Advisory Committee. Long interested in emphasizing new areas of opportunity for engineers and scientists, the following highlights some of Dr. Hollomon's opinions.

Q. Dr. Hollomon, what characterizes the new needs and wants of society?

A. There are four significant changes in recent times that characterize these needs and wants.

1. The increases in the number of people who live in cities; the accompanying need is for adequate control of air pollution, elimination of transportation bottlenecks, slum clearance, and adequate water resources.

2. The shift in our economy from agriculture and manufacturing to "services": today less than half our working population produces the food and goods for the remainder. Education, health, and recreation are new needs. They require a new information technology to eliminate the drudgery of routine mental tasks as our electrical technology eliminated routine physical drudgery.

3. The continued need for national defense and for arms reduction: the majority of our technical resources is concerned with research and development for military purposes. But increasingly, we must look to new technical means for detection and control.

4. The arising expectations of the peoples of the newly developing nations: here the "haves" of our society must provide the industry and the tools for the "have-nots" of the new countries if they are to share the advantages of modern technology. It is now clearly recognized by all that Western technology is capable of furnishing the material goods of modern life to the billions of people of the world rather than only to the millions in the West.

We see in these new wants, prospects for General Electric's future growth and contribution.

Q. Could you give us some examples?

A. We are investigating techniques for the control and measurement of air and water pollution which will be applicable not only to cities, but to individual households. We have developed, for example, new methods of purifying salt water and specific techniques for determining impurities in polluted air. General Electric is increasing its international business by furnishing power generating and transportation equipment for Africa, South America, and Southern Asia.

We are looking for other products that would be helpful to these areas to develop their economy and to improve their way of life. We can develop new information systems, new ways of storing and retrieving information, or handling it in computers. We can design new devices that do some of the thinking functions of men, that will make education more effective and perhaps contribute substantially to reducing the cost of medical treatment. We can design new devices for more efficient "paper handling" in the service industries.

Q. If I want to be a part of this new activity, how should I plan my career?

A. First of all, recognize that the meeting of needs and wants of society with products and services is most important and satisfying work. Today this activity requires not only knowledge of science and technology but also of economics, sociology and the best of the past as learned from the liberal arts. To do the engineering involved requires, at least for young men, the most varied experience possible. This means working at a number of different jobs involving different science and technology and different products. This kind of experience for engineers is one of the best means of learning how to conceive and design —how to be able to meet the changing requirements of the times.

For scientists, look to those new fields in biology, biophysics, information, and power generation that afford the most challenge in understanding the world in which we live.

But above all else, the science explosion of the last several decades means that the tools you will use as an engineer or as a scientist and the knowledge involved will change during your lifetime. Thus, you must be in a position to continue your education, either on your own or in courses at universities or in special courses sponsored by the company for which you work.

Q. Does General Electric offer these advantages to a young scientist or engineer?

A. General Electric is a large diversified company in which young men have the opportunity of working on a variety of problems with experienced people at the forefront of science and technology. There are a number of laboratories where research and advanced development is and has been traditional. The Company offers incentives for graduate studies, as well as a number of educational programs with expert and experienced teachers. Talk to your placement officers and members of your faculty. I hope you will plan to meet our representative when he visits the campus.

A recent address by Dr. Hollomon entitled "Engineering's Great Challenge — the 1960's," will be of interest to most Juniors, Seniors, and Graduate Students. It's available by addressing your request to: Dr. J. H. Hollomon, Section 699-2, General Electric Company, Schenectady 5, N.Y.

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All applicants will receive consideration for employment without regard to race, creed, color, or national origin.